CONTRA COSTA
WATER DISTRICT

1331 Concord Avenue
P.O. Box H2O
Concord, CA 94524
(925) 688-8000 FAX (925) 688-8122
www.ccwater.com

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Delta Stewardship Council
980 9th St Suite 1500
Sacramento, CA 95814

Dear Chairman Isenberg and Council Members:

Contra Costa Water District (CCWD) commends the Delta Stewardship Council (Council) on the effort that is being put forth to create the Delta Plan. The ecosystem white paper that was released was an excellent first draft but we believe that additional white papers might benefit from a broader perspective, focusing on the interface between science and policy rather than a collection of the most recently published scientific papers. If the Council continues with the very technical approach put forth in the current ecosystem white paper, it is imperative that the document be technically accurate. Although most sections of the ecosystem white paper were technically accurate, sections 3 and 4 must be improved.

Section 3 "Estuarine Mixing: Tides, River Flows and Resulting Salinity Variability are key to Estuarine Ecology" contains the statement that "Humans have completely altered the geometry of the estuary through…regulating Delta salinity to be as uniform and low as possible". This is obviously incorrect: making salinity as low as possible would be accomplished by prohibiting all diversions from, as well as discharges to, the watershed. One could argue the exact opposite is true: the story of the modern Delta has centered on exactly how saline the Delta can be allowed to get in order to maximize water diversions from the system. A correct statement regarding salinity would be "…regulating salinity in an attempt to meet conflicting demands for water quality, water supply and ecosystem needs such that there is decreased variability and increased salinity levels in Suisun Bay and the western Delta".

Section 4 "The Decline of the Delta and Suisun Ecosystem" also needs improvement. Water quality degradation has been a concern in the Delta for over a century, and it is a key factor to be addressed in order to restore the environment and protect drinking water from the Delta. The historical record and published studies show the Delta is now managed at an average salinity level much higher than would have occurred under natural conditions, the causes of which are both the channelization of the Delta (which has increased tidal dispersion of salt into the Delta) and diversions of freshwater from above and out of the Delta. Improving the description of water quality in the Delta Plan will both increase the technical credibility of the documents and highlight the importance of this issue. We have attached technical edits and additional language for your consideration.

CCWD appreciates the opportunity to participate in the development of the Delta Plan and we look forward to continuing to work together in the future. Please call me at (925) 688-8100 or Maureen Martin at (925) 688-8323 if you have any questions or concerns.

Sincerely,

Greg Gartrell
Assistant General Manager

GG/MM:wec

Attachment

Section 2
p. 2-20 line 6. Ammonia discharge from wastewater treatment plants contributing to toxicity in smelt needs a reference.

p. 2-21 line 10-21. This whole paragraph needs references or should be removed. This section appears to make the claim that there are "hydraulic cues" that salmon and steelhead respond to. We are unaware of any studies that show salmon respond to 'net flow' (e.g., the average velocity at a location over a given time period). Section 3 shows that in most instances, net flows caused by human activities are a small fraction of the instantaneous tidal flow. Fish experience local velocity (not flow) and we are aware of no studies that show if or how fish can detect a small change in tidal velocity due to an imposed net velocity that is one or two orders of magnitude smaller than the tidal velocities. Where net velocities approach the tidal velocity (for example, in Old and Middle Rivers when exports exceed about 6,000 cubic feet per second plus 50% of the San Joaquin River inflow) salvage is seen to increase markedly, but this is due to the loss of the ebb tide (i.e., the hydraulics become largely a one-way advective process, as opposed to a two-way tidal process).

The hydraulics do affect chemical patterns and it is very likely that the reverse salinity gradients caused by high salinity in the San Joaquin River and south Delta do affect salmon migration by confusing salinity cues. But this is a very much different process than the "hydraulic cue" claimed.

Section 3
p. 3-1 Lines 15-17 should read The San Francisco Bay-Delta estuary now lacks many of these critical attributes and modern management activities have reduced variability.

p. 3-1 Lines 25-26 Delete these lines…

p. 3-3 Figure 3-2, why is the westernmost flow arrow unidirectional? It would also be helpful if there was a legend identifying where those measurements are taken

p. 3-3 line 27 should read… altering salinity magnitude and variability both temporally and spatially throughout the Delta, …

p. 3-4 line 2 please elaborate more on "frequent shifts of the salinity gradient away from down-estuary natural state"…This is the first and last time that concept appears in the text. There are no mentions of causes for this or no references to actual published observations or graphs of public data (all are readily available).

Section 4
p. 4-4 line 1 Please incorporate the following text to accompany figure 4-1.

Figure 4-1 shows historical trends of Sacramento and San Joaquin River Basin runoff, trends of reservoir storage in each of those basins, delta diversions and exports, irrigated acreage in the

Central Valley and winter and fall salinity at the confluence of the Sacramento and San Joaquin Rivers. The two top plots show that runoff in the upper water shed is extremely variable from year to year. This extreme variability in water supply prompted dam construction in the upper watershed to ensure a more reliable water supply. The greatest increase in upstream reservoir storage occurred from the 1920's through the 1960's. Prior to the construction of major water management reservoirs, irrigated acreage grew to about 4 MAF. The construction of the reservoirs allowed irrigated acreage to increase to about 9 MAF. Since 1951, when the first south Delta export facility was completed, annual diversions from the Delta have increased to a maximum of about 6 MAF; total annual diversions from the system are estimated at up to 15 MAF. A consequence of the increases in water stored upstream and increases in demand (exports and irrigation) is greater sea water intrusion and a saltier Delta, particularly in the fall months. Prior to 1976, fall salinity was high only in relatively dry years; recently, fall salinity is high almost every year. High salinity in the fall has been identified as a factor in the decline of the Delta ecosystem. Baxter *et al.* (2008) noted that "fall salinity has been relatively high during the POD years, with X2 positioned further [sic] upstream, despite moderate to high outflow conditions during the previous winter and spring of most years."

p. 4-7 lines 1-6 should be consistent with the stressors outlined in the table so the paragraph should read…

Wetland and floodplain reclamation has contributed significantly to four major stressors to the ecosystem: 1) loss of physical habitat; 2) loss of habitat and interface connectivity; 3) altered geometry combined with altered flows leads to greater salinity intrusion and greater tidal mixing (increased tidal energy); 4) decrease in residence time variability.

p. 4.7 Dams section would make more sense if it were moved after the channel reconfiguration section. The dams section should also include a paragraph on the effects on sediment transport in the system and the importance of turbidity to Delta smelt.

p. 4-10 The quality of Figure 4-6 needs improvement.

p. 4-11 lines 11-21 Upstream Diversions – The section should make clear that the diversions that led to the salinity intrusion in the 1920's and 1930's were primarily upstream diversions.

p. 4-11 line 26 should read…Flows through the Delta are now highly regulated to meet water demands, provide flood control, maintain water quality standards, and in recent years to protect fisheries.

p. 4-11 Line 40 should read…Unscreened water diversions cause direct mortality…

p. 4-12 Figure 4-7 has no legend or explanation for what those stars are. Are they major diversion points? If so, it would help if they were scaled to size to show the maximum capacity of each of those pump stations.

p. 4-12 ‘Agricultural, Industrial, and Urban Discharges’ section should include a discussion of elevated salinity that results from agricultural runoff and drainage; this is a major problem that has been well documented in the San Joaquin Basin.

p. 4-14 lines 1-8 The list does not match the summary tables or previous lists of stressors

p. 4-17 lines 15 should read… Today, net flows in the southern Delta have a strong north-south directionality towards the export pumps…

p. 4-17 line 26-29 should read… Upstream diversions for agriculture have greatly reduced San Joaquin River flows into the Delta. Once in the Delta, much and at times all of the San Joaquin River flow is diverted by local agricultural intakes or exported through the southern export facilities and does not flow out of the Delta westward towards the ocean.

p. 4-19 Figure 4-10 does not show temporal trends in tidal energy dissipation and so does not support the text on line 14 of the same page.

p. 4-20 line 23 should read…Compared to historical conditions, the Delta is well connected and well mixed, resulting in shorter and more uniform residence times.

p. 4-20 Low Salinity Variability Section would be improved by removing the first paragraph in the section and the addition of the text below.
~~The Delta of today is managed to keep salinity uniformly low year-round throughout all but the most western extent of the Delta in order to meet salinity needs for in-Delta and exported uses. In-Delta agricultural diversions are the most widespread and numerous and require freshwater throughout the irrigation season (roughly late spring into the fall). South Delta exports for agriculture require the same regime. Public water supplies drawn from the Delta are few in number but are large in demand as they serve 25 million Californians. Exports require freshwater when operating, which is year-round for most facilities. Recently, Delta exports have gone to fill new south-of-Delta reservoirs, with export timing depending upon a variety of factors. This management regime actively seeks to reduce the exact variability essential to estuarine productivity.~~
As noted in the introduction to this paper, on page 2-3 lines 31-33 indicate that “intertidal wetlands of the Delta were freshwater ecosystem; it is thought that brackish water only occasionally intruded beyond Suisuin Marsh except during severe, multi-decadal drought (Moyle et al 2010)”. Paleosalinity data indicate that even during long droughts when there was substantial salinity intrusion into Suisun Bay, Delta salinity remained predominately fresh (Ingram and DePaolo, 1993; Wells and Goman, 1995; Ingram *et al.*, 1996; May, 1999; Byrne *et al.*, 2001; Goman and Wells, 2000; Starratt, 2001; Malamud-Roam and Ingram, 2004; Malamud-Roam *et al.*, 2006; Malamud-Roam *et al.*, 2007; and Goman *et al.*, 2008). This is thought to be due to in part to the substantial reduction in tidal flow by the tidal marshes of the Delta; channelization of the Delta now allows much greater tidal dispersion of salinity into the Delta.

The historical record and published studies show the Delta is now managed at an average salinity level much higher than would have occurred under natural conditions (Enright and Culberson

2009, Contra Costa Water District 2010). Human activities, including channelization of the Delta, elimination of tidal marsh, and water diversions, have resulted in increased salinity levels in the Delta during the past 150 years. The recent increase in salinity began after the Delta freshwater marshes had been drained, after the Delta was channelized and after large-scale upstream diversions of water, largely for agricultural purposes, had significantly reduced flows from the tributaries into the Delta. It has continued, even after the construction of reservoirs that have been used in part to manage salinity intrusion.

Seasonal and inter-annual variation in salinity has also been changed, largely as the result of reduced freshwater flows into the Delta. At any given location in the western Delta and Suisun Bay, the percentage of time during the year when fresh water is present has been greatly reduced or, in some cases, largely eliminated.

The recent report on Pelagic Organism Decline (POD, Baxter *et al.*, 2008) indicated that reduced flow variability under the current water management conditions may have exacerbated the effects of predation on the population abundance of pelagic fish species in the Bay-Delta estuary. Native species of the Bay-Delta system adapted to the historical salinity conditions that occurred prior to large-scale water management practices and physical changes in the Delta. The historical salinity conditions in the Delta provide insight into the response of fish species to proposed ecosystem restoration actions, and the response of species to future changes in climate or water management. Water management practices result in a saltier Delta during both wet and dry years, but the effect is more pronounced in the dry years when the seasonal variability of salinity is also significantly reduced.